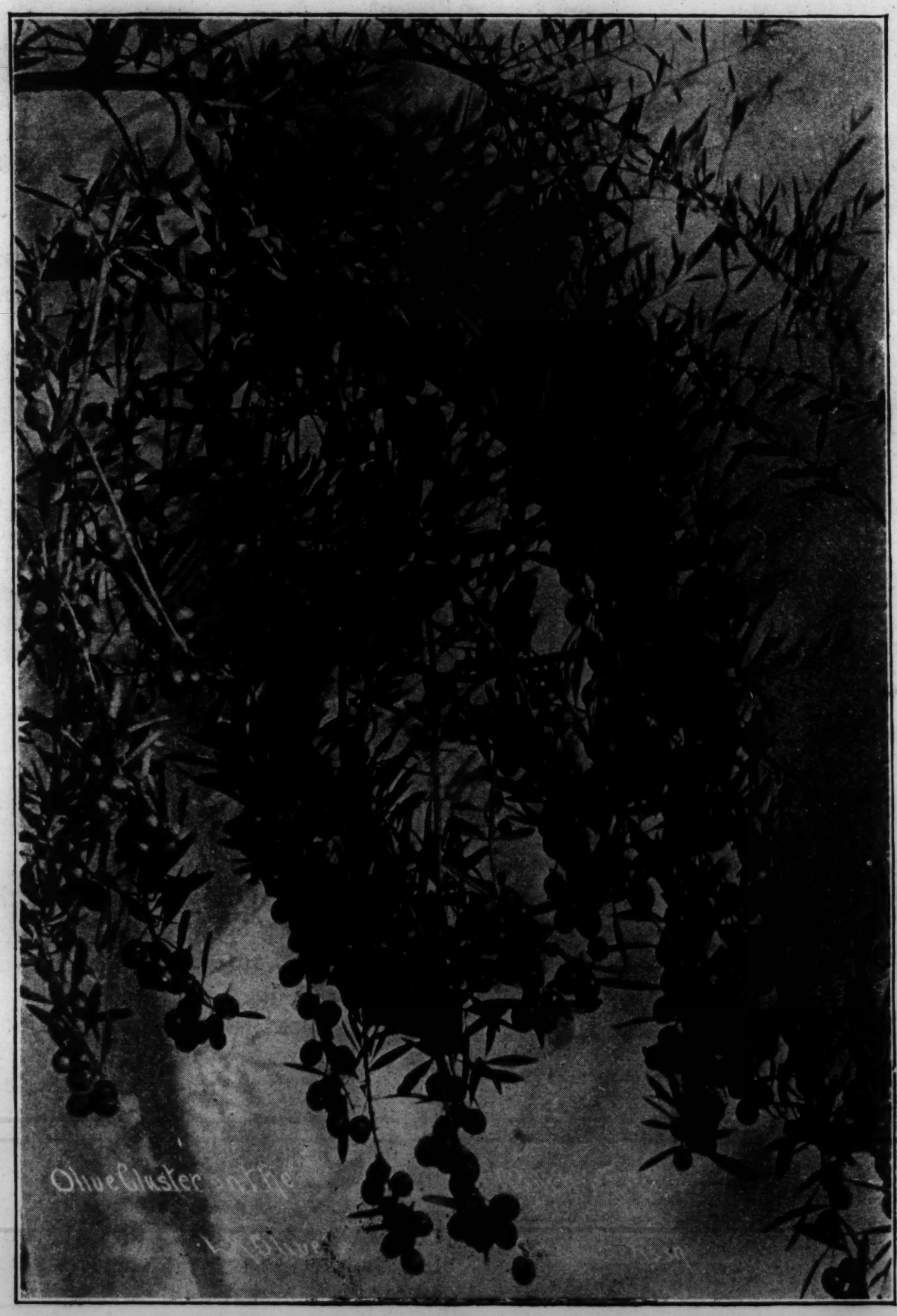
CALIFORNIA STATE BOARD OF HEALTH

MONTHLY BULLETIN

VOL. 16 SEPTEMBER, 1920 No. 3



Branch of California olive tree showing fruit.

¶SPECIAL—BOTULISM NUMBER

CALIFORNIA STATE BOARD OF HEALTH

MONTHLY BULLETIN

A Journal for the Promotion of Public Health

SACRAMENTO, SEPTEMBER, 1920.

Botulism Is Reportable Disease.

Health officers should bear in mind the fact that botulism has been made reportable under regulation of the State Board of Health and any cases of illness that may be considered as cases of botulism should be reported immediately to the State Board of Health. Physicians should be notified that this disease is reportable in order that the local health officers may receive such reports from practitioners.

How About the Milk Supply?

Do you really know where the milk that you drink comes from? Does it come from a clean dairy? Is it properly handled and properly kept? These questions are for health officers and public health nurses to consider. This is the season of the year when dirty milk levies its greatest toll in the lives of little children. Gastro-intestinal disturbances in children, due to the use of dirty milk, are more common during August and September than other months of the year.

Good Teeth and Good Health.

There are 3333 licensed dentists in California, according to Dr. C. A. Herrick, Secretary of the State Board of Dental Examiners. Each one of these men is a factor in keeping people well, for it has been demonstrated beyond the shadow of a doubt that defective teeth are responsible for many cases of illness. From a public health point of view these 3333 dentists are most valuable allies in the prevention of disease. If the teeth of every child were cared for during childhood, many of the ills of later life might be prevented. Keeping the teeth in good condition is a good way to save money that might otherwise be expended for avoidable illness, to say nothing of the needless suffering.

Mexico and Our Public Health.

Mexicans in Southern California offer many acute public health problems. The health officers of most cities in the southern part of the state find bad housing conditions and communicable diseases ever present among these people. It is possible that many outbreaks of such diseases may find their beginnings in a Mexican source. It is comparatively easy for Mexicans to cross the border unobserved, and until conditions in Mexico improve we must expect smallpox, leprosy and typhus to be brought into California by these people. Considerable responsibilty is placed upon Southern California health officers in keeping these diseases at all times under control in their communities.

RESOLUTIONS OF THE CALIFORNIA STATE BOARD OF HEALTH ON THE PACKING OF RIPE OLIVES IN CALIFORNIA.

Adopted August 7, 1920.

WHEREAS, There have occurred throughout the United States a number of human deaths from botulism contracted from eating ripe olives; and

WHEREAS, His Excellency, Governor William D. Stephens has instructed the California State Board of Health to exercise its authority toward the removal of this menace to the public health; and

WHEREAS, The California State Board of Health has determined the following facts, to wit:

A Board of Investigation consisting of Dr. E. C. Dickson, Assistant Professor of Medicine, Leland Stanford Jr. University Medical School; Karl F. Meyer, Associate Professor of Tropical Medicine, University of California Medical School, and Major J. C. Geiger, United States Public Health Service, has fully investigated the entire subject of botulism poisoning, its causes and prevention. Also, Dr. W. V. Cruess, Assistant Professor of Zymology, University of California, has carried on investigations from a commercial standpoint, regarding the effects of various methods of sterilization of ripe olives against botulism. Their findings have been fully investigated and concurred in by the California State Board of Health to the end that the following facts are now considered established:

Ripe olive poisoning is due to botulism resulting from contamination of the olives with *bacillus botulinus*. It has been found in refuse in and about olive packing establishments. *B. botulinus* is a spore-bearing organism capable of resisting boiling temperature (212 degrees Fahrenheit) for five hours. It has been demonstrated to be killed by sterilization at 240 degrees F. for forty minutes under all conditions of cooking ripe olives. It has been demonstrated that cleanliness in all processes concerned in the production of ripe olives from the time that the olive is picked until it is marketed tends to diminish the chances of contamination with *B. botulinus*; therefore, in view of the above facts, be it

Resolved, By the California State Board of Health, that ripe olives shall be deemed adulterated within the meaning of the California Pure Foods Act unless, before being offered for sale or consumption, all picking, handling, cooking and other preparation of the product shall have been carried on in strict conformity with the Food Sanitation Act, sections 1 to 8, inclusive, and that the provisions of this act will be held to apply to all holding solutions, holding tanks, separating trays, curing tanks, curing solutions, as well as to the premises generally, as specified in the act; furthermore, be it

Resolved, That ripe olives shall be deemed adulterated within the meaning of the California Pure Foods Act unless the same shall have been sterilized at a temperature of 240 degrees Fahrenheit for a period of not less than forty minutes by means of a retort or autoclave which shall be controlled by an automatic self-recording thermometer or heat-measuring device in proper working order, and that the temperature record shall be available at all times to the representatives of the State Board of Health; furthermore, be it

Resolved, That the Director of the Bureau of Foods and Drugs, California State Board of Health, be instructed to seize and quarantine all ripe olives which are not produced in conformity with the above regulations and to institute action for their condemnation and destruction.

In view of the extensive investigations recently carried on by Doctors Dickson, Meyer, Geiger and Cruess, the California State Board of Health is persuaded that the enforcement of the above regulations removes all danger from ripe olive poisoning.

MONTHLY BULLETIN

CALIFORNIA STATE BOARD OF HEALTH

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SENT FREE, ON REQUEST, TO ANY CITIZEN OF CALIFORNIA

VOL. 16 SACRAMENTO, SEPTEMBER, 1920 No. 3

THE PREVENTION OF BOTULISM FROM CANNED FOODS.

By ERNEST C. DICKSON, B. A., M. D., Associate Professor of Medicine, Stanford University, San Francisco.

There has been a marked increase in the number of recorded outbreaks of botulism in California within the past few years, although how much of this increase depends upon more careful diagnosis of outbreaks of food-poisoning is not altogether clear. Our records show that previous to the autumn of 1913 there had been only eight outbreaks of food-poisoning recorded in California in which the symptoms of the victims suggested botulism, whereas since that time there have been forty-six outbreaks, of which twenty-seven have occurred during the past two and a half years.* Not all of these outbreaks included human beings among the victims, but in all the clinical manifestations of human beings, domestic animals or domestic fowl, were typical of botulinus poisoning and in at least thirteen the diagnosis was confirmed by the demonstration of *Bacillus botulinus* or its toxin.

Six of the outbreaks of botulism in the state were attributed to foods of meat or shell-fish origin and in seven the cause of poisoning was not determined. Of the remaining forty-one outbreaks thirty-one were caused by the ingestion of home-canned vegetables, and six by home-canned fruits, leaving only four which were caused by the ingestion of commercially-canned vegetables and fruits. It is therefore apparent that the problem of botulism in so far as it has affected the consumer in California has been essentially one associated with the consumption of home-canned products.

*These data include our records to June 30, 1920.

Toxin Causes Poisoning.

The poisoning is caused by a toxin which is developed by the growth of an anaerobic spore-bearing bacillus which is called *Bacillus botulinus*. The weight of evidence indicates that the organism itself is not harmful if taken into the gastro-intestinal tract unless it is associated with preformed toxin and that it does not elaborate toxin within the body, but when it grows in suitable mediums under anaerobic conditions it forms an exceedingly potent toxin, which is poisonous for human beings as well as for certain domestic animals and fowl. Many of the foods we eat form suitable mediums for the growth of *Bacillus botulinus* and for the formation of its toxin, and the conditions within an airtight can or jar are ideal for its growth. All that is necessary for the formation of the poison in many kinds of canned food is that spores of the organism remain alive within the container after it has been processed.

It has been repeatedly shown that *Bacillus botulinus* is widely disseminated in nature and that it may be present on vegetables or fruits which are taken fresh from the garden or purchased in the open market. Since it is impossible to determine, except by prolonged laboratory test, whether any given sample of food contains spores of *Bacillus botulinus,* it is evident that we must presume that every sample of food for canning is potentially dangerous and that in our canning process we should aim to apply sufficient heat to ensure the destruction of any spores which may be present. It is, of course, essential that only sound food should be selected for

canning, as the chances of contamination are materially less than when spoiled food is used.

Bacillus Resists Boiling.

To obtain efficient processing is not an easy matter. Experiment has shown that the spores of *Bacillus botulinus* will resist the temperature of boiling water for several hours and that the only certain method of destroying them within the limits of time applicable to canning foods is by heating at temperatures considerably above that of boiling water. Small autoclaves or retorts in which these higher temperatures may be produced and which are suitable for use in the home kitchen can be purchased in the market and should be used in home-canning wherever possible.

Many persons, however, will not have access to high-pressure retorts for home-canning and will of necessity make use of one or other of the various standard methods for canning foods at home. Under no circumstances should any housewife allow the fear of botulinus poisoning to deter her from making use of these ordinary methods of home-canning food, provided she thoroughly understands that there is the possibility that the food may be a source of danger and that she is instructed how to protect herself and family against that danger. It should be remembered that although the danger of botulism is a serious one since the mortality among the victims is so high—68 per cent—the number of outbreaks has been relatively small. If the housewives are aware of the possibility of poisoning from canned food and if they will observe the necessary precautions in its use, the danger of botulinus intoxication from that source will be removed.

Boiling Destroys Toxin.

Although the spores of *Bacillus botulinus* are very resistant to heat, the toxin is quickly destroyed by boiling, and if canned foods are boiled until all parts are thoroughly heated through there is no danger of poisoning even though they have contained the toxin. There is much less danger of poisoning from fruits which are highly acid than from vegetables, but the presence of the ordinary amounts of sugar or salt does not prevent the formation of the toxin if conditions for its development are otherwise favorable. It is advised that all canned vegetables and fruits be boiled after they are removed from the container and before they are served or even tasted. The common practice of serving canned food as salad without being cooked after it is removed from the can should be discontinued although there is no reason why canned food should not be cooled after it has been boiled and served cold if so desired. There are few, if any, ready-to-serve canned foods which are in any way damaged by being boiled and cooled before they are served.

It has been said that only foods which are so spoiled as to be obviously unfit for consumption may contain the botulinus toxin, but this is not the case. It is probable that there is always more or less marked evidence of spoilage in food which is contaminated, but it may not be sufficient to attract attention if one is not on the alert to detect it. There is often some sign of gas formation, such as escape of gas under pressure when the container is opened or leaking, and usually there is a peculiarly disagreeable odor like rancid butter or certain kinds of cheese, but this odor may not be in evidence when the container is first opened and may only be noticed when the food is being cooked. At times the odor is extremely disagreeable and is of itself a cause of danger since it is not uncommon that a person who has filled the nostrils with the penetrating odor of a jar of food which contains the botulinus toxin fails to notice a less marked odor in another can or jar which may be subsequently opened; and there are cases recorded where the houswife was poisoned by eating food from a second jar of vegetables in which she had failed to recognize the odor after inhaling the more powerful odor from the first container. It should be remembered that the toxin of *Bacillus botulinus* is extremely poisonous, and that by merely tasting a small portion of contaminated food one may ingest sufficient poison to cause death. There are several cases recorded in California where women have died after merely tasting a small amount of home-canned food to determine whether it was spoiled. The common practice of tasting food from a container which has just been opened should therefore be discontinued.

Important Facts To Remember.

Prevention of botulism, therefore, depends not upon curtailing the use of home-canned or commercially-canned foods but upon the education of those who use canned foods as to the possible danger which may accompany their use and the methods for avoiding those dangers.

No canned food, or indeed any food, which shows the slightest sign of spoilage, whether in appearance or odor, should be served as food, or should be tasted to see whether it is good.

No canned foods which have not been processed at high temperatures should be served or tasted without having been thoroughly cooked after they are removed from the container; this is especially applicable to vegetables of the types which are frequently served as salads.

In case canned food shows evidence of spoilage it should not be discarded where other persons or domestic animals or fowl can gain access to it unless it has been thoroughly cooked.

If it should happen that domestic animals or fowl develop signs of poisoning after eating discarded food which has been tasted or eaten by human beings, medical advice should be sought at once in order that, if the botulinus toxin is at fault, antitoxin may be given in time to be of value.

THE DISTRIBUTION OF THE SPORES OF B. BOTULINUS IN NATURE.

By Dr. K. F. Meyer, George Williams Hooper Foundation for Medical Research, University of California.

A recent compilation of the epidemiological data thus far collected by Dr. J. C. Geiger, Surgeon, U. S. Public Health Service, supplies some interesting facts relative to the frequency and the distribution of botulism in California. Since 1900, 39 human outbreaks with a probable total of 130 cases and a mortality of 94 cases or 72.3 per cent have been recognized by direct and by indirect analysis of the available information. Botulism as a spontaneous intoxication is, however, not confined to man, thus it has been recognized by Dickson as a malady of the fowl and other domesticated birds and by Graham as a disease entity in the horse and mule. To the above list 42 outbreaks of botulism of the fowl and 78 outbreaks of so-called "forage poisoning" or probably in the majority of instances botulism of horses should be added, making an approximate total of 161 outbreaks in California.

Having recorded the various cases of botulism by means of a spot map it becomes evident that the disease has, as far as California is concerned, a tendency to a distinct centralization in certain localities. Some sections of the state, for example near Los Angeles, showing a pronounced number of horse, fowl and human cases, deserve in the future intensive investigation. The occurrence of botulism cases is not only confined to certain districts or counties of the state but may be even restricted to certain streets or sections of a city or village. In this connection it is of interest to note that not infrequently forage poisoning cases in horses antedated the observation of human or bird cases. In some of these localities the spores of *B. botulinus* have been demonstrated in decomposed hay, straw or similar material which served as food for the horses.

Outbreaks among chickens or barnyard birds are always closely connected with the feeding of spoiled vegetables or food, and they are therefore not infrequently associated with human cases. To be sure, botulism of the domesticated birds is invariably the result of the careless disposal of spoiled home-canned food. The recognition of the intoxication under the collective term of "limberneck of chickens" serves sometimes as a guide in locating the natural habitat of *B. botulinus*. This point is best illustrated by a few examples in the study of an outbreak of botulism in chickens in S., near San Francisco, in which 643 chickens died in four days following the feeding of garbage consisting of beans and other kitchen refuse. The following facts have thus far been established:

The string beans had been home canned by the cold-pack method; four jars were found to be spoiled, exhibiting a bad odor, and their contents were therefore thrown into the garbage. The beans were and are grown in a vegetable garden heavily fertilized with human sewage. The bacteriological study of the soil revealed the presence of *B. botulinus* spores. The strains isolated are, as far as the available methods permit us to conclude, identical with the organisms isolated from the intestines of one of the chickens. In a similar outbreak (Kl.) it was possible to demonstrate the presence of *B. botulinus* in the soil, on the bean stalks, the bean husks, and in the crop of the poisoned chicken. The cycle of the infection or intoxication could probably have been

closed if the jar of home-canned string beans were still available. The evidence, however, is sufficiently conclusive to indicate that the soil or the dust derived from it contaminated the beans and spores of *B. botulinus* were introduced into the canned jars. *The method of sterilization employed in the home-canning process are not sufficient to kill this resistant form of B. botulinus.* The beans being an excellent medium for the development of this particular microbe, the factors necessary for the production of botulism poison in the jar were readily fulfilled. The feeding of these spoiled vegetables quite naturally led to the fatalities.

From these observations it is obvious that the origin of the *B. botulinus* was in every instance traced to the soil. Immediately the important question arises how do the *B. botulinus* and its spores get into the soil. The present knowledge concerning soil-born diseases is rather meager, but it is known that anthrax and blackleg of domesticated animals are quite frequently confined to certain districts and areas. Moreover, lockjaw or tetanus occur only in countries or territories which have been tilled for centuries. The careless burial of blackleg and anthrax carcasses or the fertilization of land with animal manure are evidently some of the factors which contribute to the pollution of the soil with disease-producing spores. With regard to tetanus, it is known that horse manure can harbor tetanus germs, and a number of investigators have demonstrated the fact that certain horses may act as true "tetanus spore carriers." By analogy, one could suspect that the soil of California is or has become polluted with botulism spores through the use of manure or other fertilizing material. Some observations made in connection with the outbreak in Kl. justify this deduction and warrant a very extensive investigation. The facts are briefly as follows:

For eight years previous to 1918 an owner of a small vegetable garden grew and home-canned string beans without any spoilage. In 1918 the garden was fertilized with animal manure; the beans grown during this year were canned by the same method used previously, the jars promptly spoiled and some contained the botulism poison.

If one begins to associate *B. botulinus* spores with animal manure an endless chain of problems for investigation suggest themselves, particularly when one recalls that Kempner and Pollack recovered in Germany on one occasion *B. botulinus* from the intestinal tract of a hog. A somewhat similar observation has been made by Dickson and Burke, who isolated the organism from the manure of a large hog which had recovered from botulism three months before the specimen was taken. Until the investigations dealing with this aspect of botulism are properly completed it is impossible to recite or to surmise the mechanism which leads to a pollution of soil with spores.

Having recognized the soil as a source of *B. botulinus* it appears logical to suspect that vegetables may be contaminated with spores. This suspicion has been proven to be correct, namely, peas, beets, radishes, asparagus, carrots, parsnips and string beans bought in the open market in San Francisco revealed by cultural methods the presence of *B. botulinus* spores.

Dickson and Burke have reported the finding of spores on bird-pecked, bruised and molded cherries, while our tests demonstrate the organisms on bird-pecked apricots and unbroken olives on the tree. These laboratory results are confirmed and can well be correlated with some of the epidemiological observations. In sixteen outbreaks the goods used for home-canning were purchased in the open market. Among the fruits and vegetables which apparently carried *B. botulinus* spores, are to be mentioned, pears (one outbreak), beans (seven outbreaks), asparagus (five outbreaks) and apricots (three outbreaks).

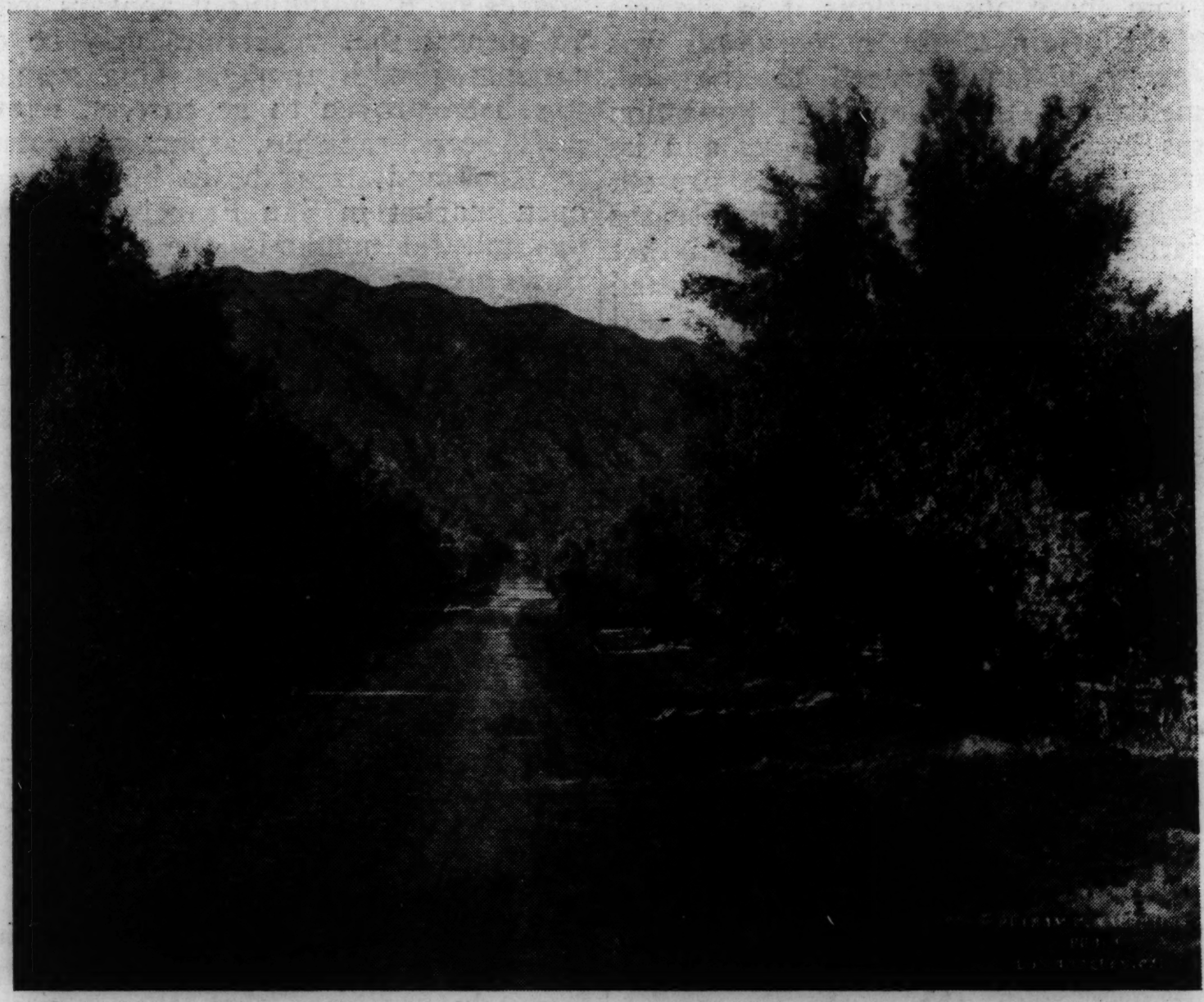
In conclusion it can be stated the information thus far at hand and briefly sketched in the preceding paragraphs definitely indicates that the spores of *B. botulinus* are widely distributed in California and that they may be on the vegetables or fruits when they are picked or bought in the open market. It is also quite obvious that under these circumstances protection against botulism can only be achieved by either sterilization of the food product to be preserved at a temperature above boiling and under pressure, or by cooking the contaminated food before eating or even better by ruthless discarding of any canned vegetable or fruit which shows the least sign of spoilage.

SCIENTIFIC METHODS OF PROCESSING AND PACKING THE CALIFORNIA RIPE OLIVE.

By Frank Simonds, President of the California Olive Association.

The initial step in preparing the ripe olive for processing is to see that the lug boxes or other containers that may be used in the field for collecting the fruit have been properly sterilized if they have been used before. No container should be sent to the field for the purpose of transporting the fruit to the factory that is in any respect dirty, as this would be a source of contamination of the fruit. Wash the boxes out thoroughly, or, better still, if live steam could be forced into them, thus insuring the removal of any particles of mold, dirt or other material that might result in contamination.

The pickers in the field should be individually instructed not to pick up any windfalls or fruit that may have become bruised in the operation of removing it from the trees. All fruit of this kind should be left on the ground to be picked up later by other pickers who might be especially assigned to collect the undesirable fruit for oil making or other purposes. No fruit should be removed from the tree until it has reached at least a fair degree of maturity.



A southern California olive orchard.

Neither Too Green Nor Too Ripe.

For the purpose of processing into the commercial canned ripe olive, care must be exercised that the fruit is neither too green nor overripe. As a guide, the California Olive Association adopted a resolution which covers this matter in the most practical way possible. The resolution is as follows:

"At the beginning of the harvest, the guide for picking the fruit (Manzanillo and Mission varieties) should be color only, and no fruit should be picked for processing unless it has reached the stage where at least part of its surface has turned to a red or darker shade of color. This guide should be used until the season has advanced far enough when all olives, regardless of color, will easily free themselves from the pit under pressure of the thumb and forefinger, at which time all olives are considered ripe, regardless of any color whatever."

All fruit should be removed from the field within 24 hours after being gathered from the tree, thus preventing it from withering or shriveling. If the fruit is to be shipped to some distant

point to reach the canning plant, it is necessary to put it into a solution of salt brine, the initial solution testing about 15° salometer strength. In accumulating a shipment, the brine should be strengthened from day to day as it is being held until the shipment is made, at which time the strength of the solution should be up to 32° salometer strength.

It would be advisable for a grower shipping olives to purchase a salometer and suitable test tube and familiarize himself with using it, so he may determine the strength of the solution accurately and keep it at the proper degree. This instrument is inexpensive and easily manipulated.

Cleanliness Essential.

When selecting packages to use in which to transport fruit from a distance to a plant, the same care as to cleanliness which is advised in connection with the field boxes should be taken. If barrels are used, they should be thoroughly sterilized in some efficient manner. Where live steam is available, it is one of the most convenient and effective methods. It has been necessary at times to take out the head and scrape the inside of the barrel with an instrument designed for that purpose. No barrel with a foul or sour odor should be used.

Upon receiving the fruit at the factory and entering the necessary weight records, the fruit is ready to be graded for size, it being advisable in this operation to follow the standards adopted by the California Olive Association, thus securing a uniform system of size, grading and names for submitting to the public and the trade. A confusion of the different gradings and names by individual packers is very annoying to the buyers and the public. Names and size grades were adopted by the above named association on June 27, 1917, as follows:

Picking olives in a California orchard.

Olives counting—

120	to	135	per pound termed	Standard
105	to	120	per pound termed	Medium
90	to	105	per pound termed	Large
75	to	90	per pound termed	Extra Large
65	to	75	per pound termed	Mammoth
55	to	65	per pound termed	Giant
45	to	55	per pound termed	Jumbo
35	to	45	per pound termed	Colossal

There are different models and types of machines for grading the fruit into sizes. The best guide to be used in testing the operation of the machine is to weigh a pound of olives after they leave the machine, then count them and

see whether they correspond with the adopted schedule.

Some of the packers assort their fruit at this stage of the operation as to color, and in many instances it is an advantage to do so, as uniformity of the condition of the fruit renders the process less difficult. The machines for doing the grading are likely to accumulate dirt and other refuse, which should be carefully removed often so as to prevent any contamination in this department.

If the olives are taken direct from the grader to the processing vats the solution should be applied to the fruit the same as if in storage, the object being to neutralize the skin of the fruit to allow the action of the following solution to be uniform.

It is impossible to bring the fruit in from the grove in an absolute uniform condition, thus rendering it necessary to bring about such a condition through holding it in brine in order to get the best results. It usually takes from

Sterilizing olives at high temperatures in retorts.

Ready For Processing.

The fruit after having been graded for size is ready for either a storage tank or the processing vats. If placed in storage, the fruit should be immediately covered with a brine of about a 15° salometer strength. The fruit being fresh, the strength of the brine will rapidly weaken, making it necessary to watch it closely, gradually bringing it up within two days' time to a 40° salometer strength. So long as the fruit remains in storage the strength of the brine should be tested daily and at any time it is found to be falling below 40° salometer strength, enough salt should be added to "build it up." Do not put the salt directly into the container of olives. Make a strong solution by first thoroughly dissolving the salt; and add it to the brine already covering the olives, then stir with a paddle or agitate with air.

three to four weeks in this brine to render the fruit in a receptive condition for the caustic solution. If the cement vats are equipped with a system of compressed air pipes in the bottom of the vats, the action of the solution is very much quickened, and instead of it being necesary to leave the fruit soaking in the brine for three or four weeks, the same result, through continual agitation by the compressed air, can be secured in a few days' time.

Following this process, it is necessary to soak the fruit in fresh, clear water for about twelve hours. This prepares it for the lye solution following.

Then the Lye Solution.

In preparing what is commonly known as the lye solution, the usual method is to use either the solid or the granular caustic soda, 76 per cent, making a solution of 2½ ounces of

caustic soda to each gallon of water. The fruit is then immersed in this and allowed to remain from 8 to 12 hours, depending upon the condition of the fruit and the temperature of the weather at the time, agitating the fruit while in this solution. Sometimes the agitation is done at intervals by hand with a shovel or paddle, the more modern method, however, being the use of compressed air released into the solution continually.

At the end of the 12 hours or less time the lye has usually so weakened in strength that it fails to act further upon the fruit and should then be drawn off the olives, at which time, in a great many instances, the fruit is exposed to the air without any solution whatever upon it for a period of from 8 to 12 hours, which procedure usually results in a uniform color being obtained.

It is then necessary to submerge the fruit in a second application of lye, which solution is usually composed of about 1¼ ounces of caustic soda to each gallon of water. The length of time that the fruit remains in this solution varies from 8 to 12 hours, depending upon conditions, such as temperature, ripeness of the fruit, etc., after which the olives are relieved of their bitter properties through the action of the lye solutions. The next step is washing the fruit in cold water for a sufficient length of time to remove all trace of the taste of lye which has been used in the former stages of the process.

The length of time that it takes to do this varies a great deal, depending upon the condition of the fruit, temperature of the weather, and whether or not the water in which the fruit is placed is in continuous agitation.

After the taste of lye has been entirely removed, the fruit is again placed in a weak brine solution of about 12° salometer strength, in which it should remain for from 24 to 48 hours, after which it is ready for canning.

Canning Room Equipment.

The modern canning room should be equipped with the usual work tables for the female operators, the most modern of them being supplied with running water for washing off the fruit, and, for convenience, each table is supplied with a conveyor belt to carry away the packages after they have been prepared. The equipment should also include an exhaust box for insuring an even temperature of the fruit when the can is sealed.

All factories should also be provided with the necessary machines for closing or sealing the cans, and for the final operation steam retorts are necessary in which to thoroughly sterilize the packages, which retorts should be equipped with a system of compressed air, an automatic recording thermometer and a pressure gauge.

The initial cost of a retort such as is used in a commercial plant, including

An olive orchard in the Corning section.

the recording thermometer and pressure gauge, is about $1,000. It would be possible to provide for sterilizing ripe olives in a small way by using an ordinary pressure cooker such as used in hotels, and which is rapidly becoming a common kitchen utensil in modern homes. The cost of the pressure cooker is as low as $25.

In addition to this equipment it is also necessary to provide power for operating the various machines and conveyors, and for supplying heat a steam boiler must be installed.

Procedure in the Canning Room.

The processed fruit should be brought in and placed in troughs before the operators, and first it should be thoroughly rinsed or washed with clear water. The operators are then ready to fill the packages, this being done by hand, each olive being examined so that any that are unfit to eat may be discarded, and using only those olives that are perfect, to fill the cans.

The operator places the can, after having been filled, on a conveyor, at one end of which the forelady inspects each can as it passes by. Every operator is assigned a number, which number is stamped upon the empty cans given her to pack, thus providing for the tracing back of any imperfect work to the individual operator who performed it.

The cans now pass an operator who fills them with brine, which is made of a strength to suit the taste of the public, usually about a 14° salometer strength salt solution.

The cans are next put through the exhaust box, which heats the can and fruit to about 185°, and immediately after emerging from this steam box the can passes through an automatic sealing machine which hermetically seals it. An operator receives the cans as discharged from the machine and places them in an iron truck, which rapidly fills and is run into the retort, the doors closed tightly, the steam turned on, and the temperature brought to 240 degrees, at which point the heat is maintained for a period of forty minutes, which thoroughly cooks and sterilizes the package and contents.

Much care must be exercised at this particular stage, especially if No. 10 or gallon cans are being sterilized. An immediate release of the pressure might cause the internal expansion of the contents of the can to burst it or at least to so badly buckle the can as to disfigure its appearance. In order to prevent this, compressed air should be turned into the retort before the steam is released, bringing the pressure to about 15 pounds and holding it there. The operator then may release the steam pressure, maintaining the air pressure until the packages are sufficiently cool to prevent any disfigurement of the cans.

Forty Minute Sterilization.

All operators should be instructed that under no condition should any compressed air be allowed to be turned into the retort until after the full forty minutes of sterilization has been reached, as a uniform cooking of the fruit can not be accomplished under these conditions. The air should only be used after the sterilization has been completed for the purpose of holding the packages in proper shape until they are sufficiently cool to relieve the internal expansion. Perforated water pipes in the top of a retort can be used for the cooling of the fruit, sprinkling the cold water over the cans, providing of course the water pressure is greater than the air pressure used as above described.

If olives are being sterilized without the use of compressed air extra precaution should be used in turning off the steam pressure, doing it very gradually so as to permit the packages to become partially cooled by the time the steam pressure is entirely released. The safest method, however, is with the use of the air.

The temperature records as registered upon the recording thermometer should be preserved and filed away each day with proper notations made on them so that any particular batch of fruit that goes through the cooker may be traced at any time thereafter.

OLIVE PICKLING AND STERILIZING EXPERIMENTS.

By W. V. CRUESS, Assistant Professor of Fruit Products, University of California.

Late in November, 1919, the Division of Viticulture and Fruit Products of the University was asked to undertake a series of experiments to determine the effect of high temperatures of sterilization upon the quality of ripe olives and to study methods and conditions in commercial olive pickling plants. A fund of $1,000 was provided from the state fund known as the deciduous fruits appropriation, under which olives are specifically mentioned as one of the fruits to be benefitted. This appropriation is under the direction of Dr. J. C. Whitten of the College of Agriculture, who has actively cooperated with our division in this and in other investigations pertaining to the olive.

Survey of Commercial Methods.

A. W. Christie and the writer, in cooperation with the members of the National Canners' laboratory of southern California, first made a brief study of the methods of handling the unpickled fruit, methods of pickling, storing the pickled fruit before canning, and the temperatures and times of sterilization in use in various plants throughout the state. A summary of the results of these observations follows:

Shipping the Fresh Fruit—Olives are usually shipped long distances in dilute solutions of brine known as "holding solutions" or as "standing solutions." In a few cases the fruit is shipped in lug boxes, but this practice is not a common one because of the danger of loss of fruit or deterioration of quality through molding or fermentation. The holding solution prevents bruising of the fruit and toughens the flesh so that results obtained in pickling are more uniform and less fruit is lost by be-

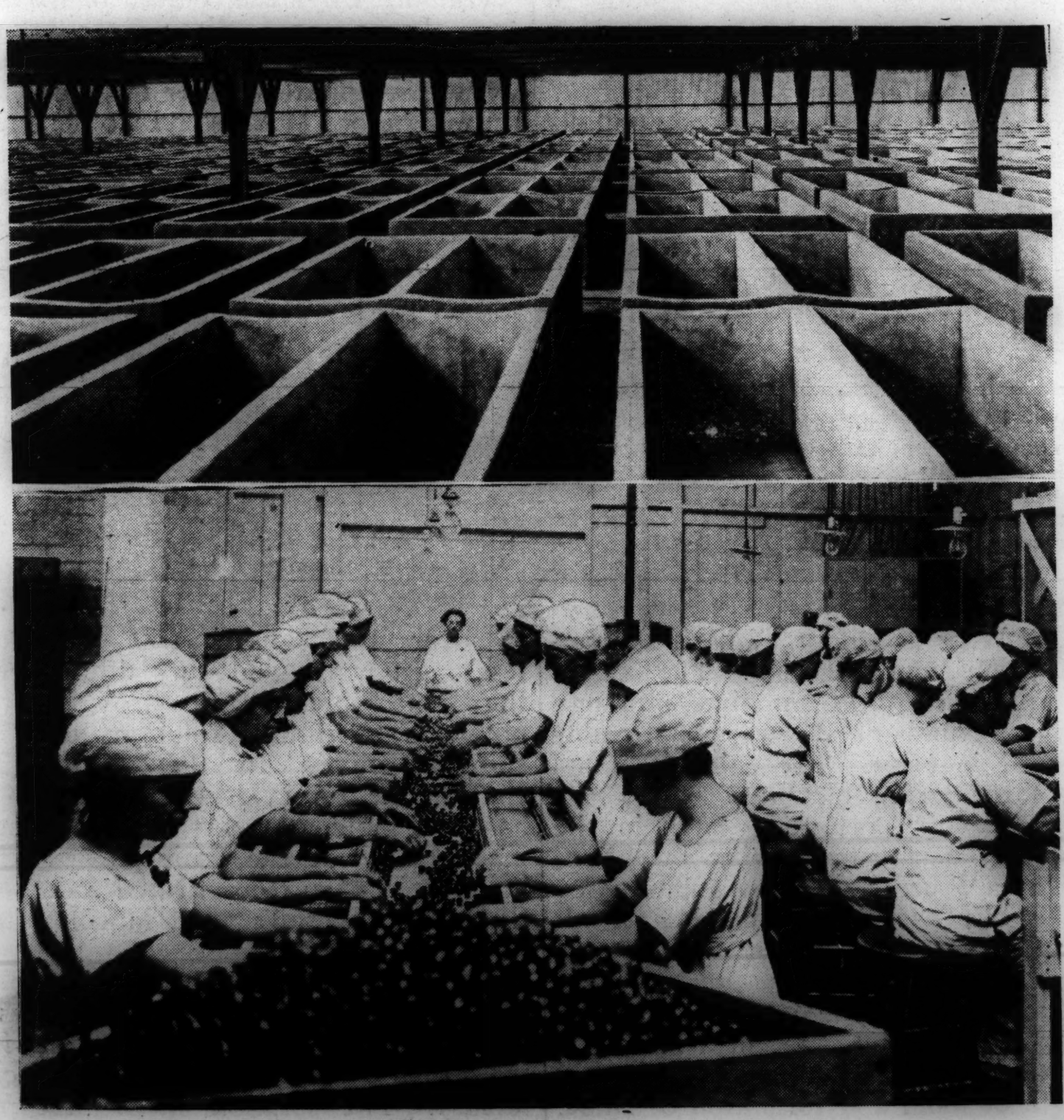


FIGURE 1—Above, concrete pickling vats in Olive Products Company's plant at Oroville. Easily cleaned and sanitary. Below, sorting olives in the above plant.

coming too soft for canning. Fifty-gallon barrels are the containers most commonly used, although wooden or metal tanks holding 1500 or more gallons of olives and solution are in use by at least one company.

In all cases the brines in use were not sufficiently high in salt content to prevent the growth of micro-organisms. The type of growth occuring in the olives and holding solutions varied with the concentration of salt used. In very dilute brines a vigorous gaseous fermentation occurred with the production of a disagreeable odor. This was often followed by the development of a heavy film on the surface of the liquid and a slimy growth of mold and bacteria on the surface of the olives. These dilute brines represented an addition of five pounds or less salt and about 20 gallons of water per 50-gallon barrel of olives.

Where the amount of salt was increased to 10 pounds per 50-gallon barrel, although there was active bacterial growth, this consisted chiefly of lactic acid-forming organisms. The odor of such olives was sound; there was very little gas production and no formation of slime on the surface of the fruit. Two such solutions were examined by McKim of the National Canners' laboratory of Los Angeles with the following results:

barrel of water and fruit. This corresponds to a brine of 4 per cent to 5 per cent. This solution is not strong enough to permanently shrivel the fruit but still contains enough salt to check the growth of undesirable organisms. We do not believe that the growth of lactic acid-forming organisms is objectionable and even believe that such growth improves the flavor of the finished product. However, in view of the fact that we do not know to what extent *B. botulinus* may develop in such brines it is a safer plan to add more salt to the olives as soon as they are received at the factory in the solution noted above and thus increase the salt content to the point where practically no growth of any kind can take place. This will be, during the cold weather prevailing during the pickling season, a solution of 10° to 12° Baumé. By increasing the concentration of the salt by several rather than by one addition, this concentration may be reached without causing shrivelling of the fruit.

Holding Unpickled Olives in the Factory—In one case olives were brought to the factory direct from the orchard and were stored in water for more than a week before pickling. In others, very dilute brines were used. In one factory the holding solution was gradually "built up" by frequent additions of salt

	Specific gravity of brine	Baume degree of brine	Salt per cent by titration	Acid per cent as lactic	Yeast and mold spores per 1-60 c.m.m.	Bacteria millions per c. c.
Number 1: Olives and brine freshly made up; 24 hours old when tested	1.0312	4.3	3.83	.0476	3	8
Number 2: Olives and brine after 2 weeks in 50-gallon barrels	1.0260	4	2.56	.189	14	29

The flavor and odor of both samples was clean and pleasing. The olives were firm and free from slime, although sample Number 2 was noticeably bleached in color. The color is found to return during pickling.

Experiments performed later in the laboratory demonstrated that the olives held in a 5 per cent brine solution for two weeks or less remained firm although lactic acid fermentation occurred. The olives gave an excellent product after pickling. Olives placed in 2 per cent and 3 per cent brines gave less satisfactory results because of rapid growth of mold and formation of slime.

The writer believes that olives to be shipped long distances should receive at least 10 pounds of salt per 50-gallon

to over 10° Baumé (40° salometer test). In water and very dilute brines the same objectionable growths were noted as in similar solutions used for shipping olives. In the solutions of 10° Baumé no evidence of growth of bacteria, mold, or yeast could be noted. The quality of the fruit pickled after holding in this concentrated salt solution was uniformly good in color, texture and flavor.

It is suggested therefore that olive pickling factories endeavor to use stronger holding solutions in the factory than has in the past been customary. The solution when first prepared should test at least 5° Baumé (20° salometer) and if the fruit is held for more than a week should be in-

creased to at least 8° Baumé (32° salometer).

Barrels and tanks used for shipment or storage should be thoroughly disinfected before use. Dilute chloride of lime or bleaching soda or a strong lye solution (5° or 6° Baumé, 20° to 25° salometer test) will be effective and may be removed from the containers by thorough rinsing. Burning of sulfur in wet barrels just before they leave the factory for the orchard would also be advisable as a means of keeping the barrels "sweet" until they reach the shipping point.

The Lye Process—Olives are treated with dilute lye to destroy the bitter principle and to facilitate darkening of the color by oxidation. The lye ordinarily used is sodium hydroxide. The strength of the solution varies from ½ per cent to 1½ per cent depending upon the factory, the variety of olives and the condition of the fruit.

During the lye treatment, which may last from about six to about twenty hours, according to other conditions, the olives are stirred frequently with compressed air or with a paddle. It has been noted that the lye solution checks fermentation and therefore appears to have an appreciable antiseptic action. Because of the aeration given the lye and olives and because of the antiseptic value of the lye itself, the writer believes that little growth of *B. botulinus* occurs during the lye process.. The low temperature of the lye solution (40° F. to 60° F.) is also unfavorable to bacterial growth.

Oxidation of the Color by Exposure—Ripe olives in most factories are darkened in color by exposure of the fruit to the air for 24 to 124 hours after a preliminary lye treatment, or by alternate lye treatments and exposure to air for shorter periods than those given above. Because of the exposure to the air and because the olives are frequently stirred the writer does not believe that *B. botulinus* is given much opportunity for growth in this step of the process.

Oxidation of the Color in Liquids—Several factories furnish the necessary oxygen for the darkening of the fruit by forcing a vigorous stream of air through the various lye solutions through water or dilute brine placed upon the olives after the first lye treatment. The fruit is not exposed to the air where this method is used, but because of the fact that the lye or water is thoroughly saturated with air and is in violent agitation throughout the treatment little opportunity is given for the growth of anaerobic bacilli such as *Bacillus botulinus*.

Removal of the Lye—After the proper color is attained and a second lye solution to remove the bitterness has been used, the excess lye is leached from the fruit by water, which is changed frequently. In the "quick process"* the water is continuously agitated by means of compressed air and the lye is removed in from 36 to 96 hours. In the usual process a week or more time is usually required. In the "quick process," because of the continuous aeration of the wash water, little opportunity for anaerobic growth should exist; but if the usual process of washing is unduly prolonged, fermentation of the olives invariably ensues. The fruit becomes soft or filled with gas and bleached in color. Bleaching indicates a "reducing" or anaerobic set of conditions. It would appear that such a condition is favorale to the growth of *B. botulinus* and other anaerobes, especially in the flesh of the olives, if not in the brine. The fruit at this time is slightly alkaline, a condition very favorable to *B. botulinus*. The combination of an anaerobic condition, slightly alkaline reaction, and long period of washing are not conductive to holding *B. botulinus* in check. Use of the aeration or quick process would reduce the danger of growth of *B. botulinus* during this period of the process.

Curing After Removal of Lye—The olives, after removal of the lye, are stored in a dilute brine from one to 21 days before the fruit is canned. The length of time varies greatly in different factories. Where the process is prolonged for more than four or five days, growth of bacteria, bleaching of the olives and formation of gas are usually evident. Long storage in this dilute brine is even more objectionable from a bacteriological standpoint than is a long period of washing. Therefore, storage in the brine should last only long enough to prevent shrivelling during sterilization. It is believed that a maximum of 36 hours is a sufficient length of time for this process.

Sterilization—Temperatures as low as 212° F. were in use in several plants but the majority of factories employed temperatures ranging from 220° F. to 250° F. Since the past season practi-

*Public service patent, 1257584, U. S. Patent Office, 1917. W. V. Cruess.

cally all factories have installed steam pressure retorts or have ordered such equipment. It will, therefore, be possible to sterilize the entire pack of the coming season at 240° F. for 40 minutes, the time and temperature set as requirements by the State Board of Health for the sterilization of all ripe olives to be offered for sale. Several of the larger plants have also installed temperature recording and temperature regulating devices for their retorts.

A Misstatement—There appeared in a news notice published throughout the United States the following statement: "Ripe olives, which the Detroit health commission claims caused the death of the five in Detroit are not canned by the cold-pack method. The process usually employed to preserve olives is to dip them several times in lye, rinse them in fresh water, and then put them up in weak brine. *No heat is used and the brine is not strong enough to prevent toxin formation.*"

The writer wishes to state emphatically that the above statements do not agree with the facts in any way. All canned and bottled olives *are* most decidedly subjected to heat and have so been treated since ripe olives have been canned in this state.

Results of Investigations.

Effect of Temperature on Quality—Olives of three varieties, Mission, Sevillano and Manzanillo, were sterilized at temperatures ranging from 212° F. to 250° F. Two samples, Number 1 sterilized at 240° F. for 30 minutes, and Number 2 at 250° F. for 30 minutes, were submitted to 31 people for opinions. They were not told until after the fruit had been tasted and opinions given what the processes had been. Of the 31 people, 26 gave the opinion that both lots were satisfactory and merchantable, four stated that the samples were of fair quality, and one opinion was unfavorable. The lot sterilized at 250° F. was preferred to that sterilized at 240° F. because the higher temperature rendered the fruit more tender.

A large number of samples of the three varieties mentioned above and which had been sterilized at 212° F. to 250° F. were compared by a number of students. The tasting was done about three months after the fruit had been canned. The color of the fruit, except in one or two cases, was as good in the samples sterilized at 240° F. to 250° F. as in those heated at 212° F. None of the students objected to the flavor of the fruit sterilized at the high temperatures although those most familiar with the flavor of ripe olives preferred the fruit sterilized at 212° F. and could distinguish it from the other lots. However, on the other hand two of those less familiar with ripe olives preferred the fruit which had been heated to the higher temperatures because it was more tender and possessed "more character" (as they expressed it).

Olives during the first few days following sterilization at 240° F. to 250° F. possess a very distinct "scorched flavor." On standing several weeks this flavor greatly diminishes. After three months it is scarcely perceptible. Therefore the effect of high temperatures on flavor should not be judged too soon after sterilizing.

Olives containing a small amount of bitterness exhibited after sterilization

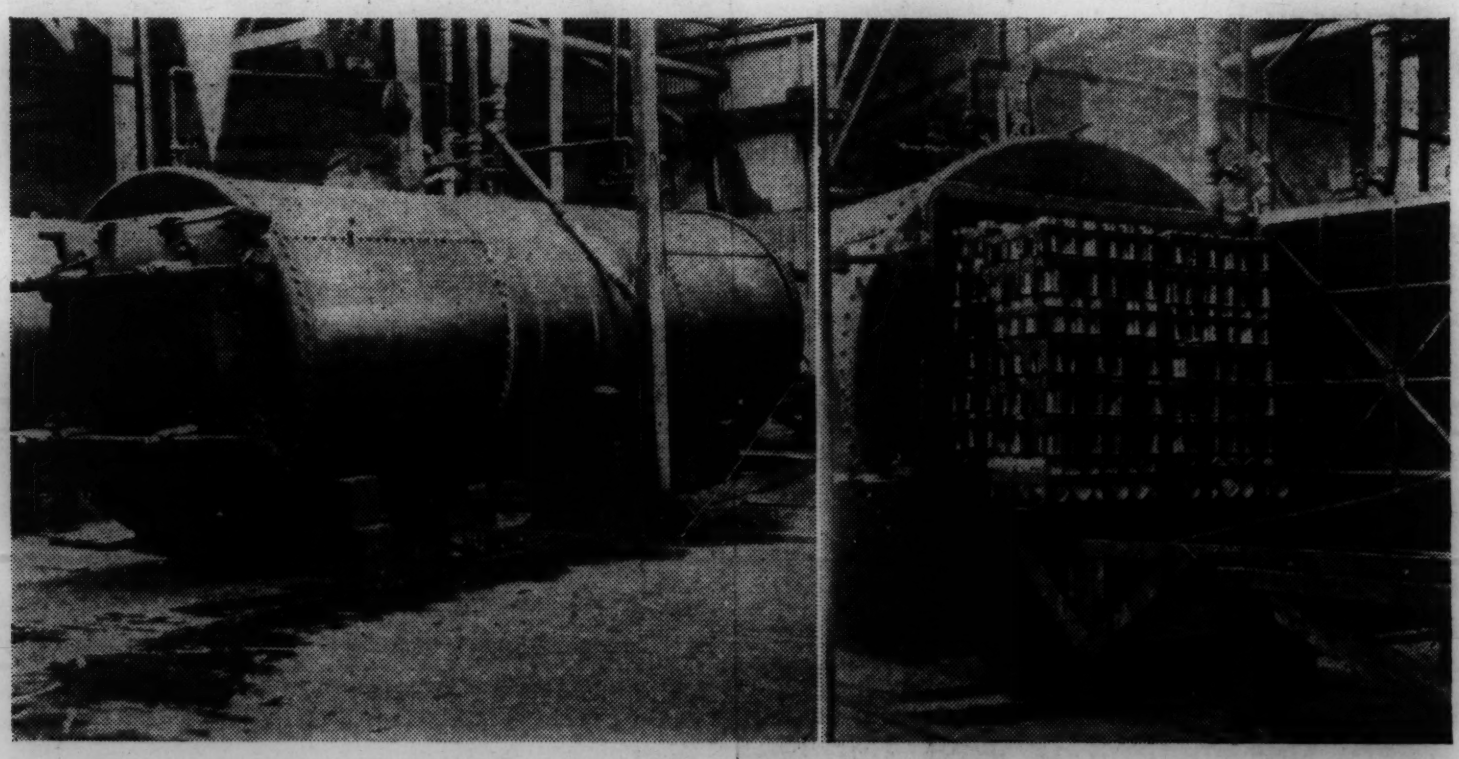


FIGURE 2—Retorts used in sterilizing olives in the California Packing Corporation's plant at Stockton. The cans shown in the photo were heated to 250° F. The flavor was very good after this treatment.

at 245° F. a pronounced "bitter almond flavor" not perceptible in fruit heated at 212° F. However, after several months' time, this flavor too was scarcely noticeable. Fruit given a more severe lye treatment to remove all of the bitterness did not develop this flavor. In fact, such fruit also did not develop nearly as noticeable a "scorched" flavor as did fruit less severely treated. This fact should be noted by olive processors.

Temperatures and times of 240° F. for 40 minutes, 235° F. for 60 minutes, 225° F. for 60 minutes, and 220° F. for 60 minutes gave palatable products. Two hundred forty degrees Fahrenheit for 60 minutes developed much more of a "scorched flavor" than did 240° F. for 40 minutes.

Effect of Acidified Brines—Lactic acid up to .4 per cent, citric to .25 per cent, and acetic to .25 per cent added to a 2½ per cent brine added to olives before canning and sterilizing at 240° F. did not materially injure the color. Because of the presence of alkali or weak salts of sodium in the fruit these acidities were reduced after sterilization to .15 per cent less. However, fruits acidified with the maximum amounts noted above were still perceptibly acid to the taste. The acids rendered the fruit rather woody in texture. After six months storage the acids had acted upon the tin plate of the cans sufficiently to cause the cans to become "hydrogen swells." Lacquered cans would be necessary if appreciable amounts of these acids were added at the time of canning.

The use of these acids has been suggested as a means of reducing the death temperature of *B. botulinus*. The writer prefers the olives sterilized at 240° F. for 40 minutes to those acidified and sterilized at a lower temperature.

Variation in Salt Content of Brine—Brines varying from 1 per cent to 10 per cent salt were placed upon pickled olives for 48 hours and the fruit was sterilized in these brines at 240° F. In another series the fruit was soaked in these brines for 48 hours and was canned in a 3 per cent brine.

In the first series, brines in excess of 5 per cent salt (20° salometer) rendered the fruit too salty to be palatable. In the second series, none of the samples were too salty.

Olives in the stronger brines were less injured in flavor by high temperatures of sterilization than the same olives in dilute brines.

Sterility of Canned Olives—Beresford and Mead have examined a number of cans and jars of olives and olive relish from various factories. Some of the results were published in the June issue of the Fig and Olive Journal. Later results have yet to be published. In the first series, none of the samples heated in glass at 212° F. were sterile; in a later series of tests, 25 per cent only were sterile. None of the samples heated at 190° F. were sterile. In the first series none of the samples in tin at 212° F. were sterile; in a later series, 50 per cent were sterile. Sevillano (Queen olives, very large) heated at 240° F. for 30 minutes (5 samples tested) were sterile; Mission olives heated to the same temperature for 30 minutes (6 samples) were all sterile. The containers were 18-ounce size. Both olives and brine were tested for sterility. All samples heated to 250° F. for 15 minutes were sterile; many samples heated at 230° F. for 15 and 30 minutes were not sterile. The fact that a smaller percentage of cans heated to 212° F. were not sterile six months after canning than one month after canning probably indicates that storage resulted in death of many of the spores which survived 212° F.

Olive relish heated at 250° F. was sterile; that in 5-ounce tins at 220° F. for 30 minutes was sterile; but that in 10-ounce tins was not sterile.

All samples of olives and relish discussed above were from commercial plants. The factory employing 240° F. for 30 minutes is equipped with a recording thermometer and Tagliabue temperature regulator and this time and temperature undoubtedly represent the true conditions actually used. Most other plants relied upon hand valves for regulation of the time and therefore the temperatures reported are probably not exact.

The results indicate that 212° F. does not sterilize and that even 230° F. for 30 minutes is not safe. Two hundred forty degrees Fahrenheit for 30 minutes apparently accomplished the desired results.

Summary.

1. Standing solutions containing more salt than has in the past been customary should be employed for shipping and storing unpickled olives.

2. The pickling process should be as rapid as is compatible with the production of satisfactory pickled fruit. Frequent or continuous aeration of the liquids used in pickling is desirable. Long storage of the pickled fruit in dilute brines is very undesirable and is unnecessary.

3. A temperature of 240° F. for 40 minutes did not materially injure the quality of ripe olives of the Mission, Manzanillo, and Sevillano varieties. Therefore, if the fruit is of good quality at the time of canning, the use of this time and temperature as now required by the State Board of Health should not injure the reputation of California ripe olives.

4. Olives processed commercially at 212° F. are not sterile. All samples examined after processing at 240° F. for 30 minutes or at 250° F. for 15 minutes were sterile.

THE RIPE OLIVE INDUSTRY.

By Chas. H. Bentley, San Francisco.

For more than a generation, California had been distributing millions of containers of ripe olives—shipped to discriminating buyers throughout this country. For many years the demand for the grades of better quality was in excess of supply. It was natural that they should be most generally used in California, where they were grown, where they were first introduced and where the packs were best known and the product most familiar to the population. Ripe olives have become a common food on account of the unusual wholesomeness and attractiveness.

It is difficult, indeed, for the grower or the packer or the consumer in California to realize that any cases of illness could have come from eating the product so generally used and approved in California. There had never been any indication of trouble in all these years, at least none that was known to growers or canners, until these few cases which came in the summer and fall of 1919. It is, of course, no comfort to the afflicted families to know that there were but few cases, but this fact gave hope that the cause and the remedy would be found.

Searching Investigation Made.

The olive industry undertook to have a complete and most searching investigation made. It secured the interest and cooperation of various agencies of the state and federal government, as well as some of the leading universities. Through them, investigators of rare scientific ability were secured and the investigation continues, but it has proceeded far enough to warrant the authorities in stating that while the micro-organism responsible is comparatively rare, it can be absolutely controlled by complete sterilization. Millions upon millions of packages have been consumed during the past thirty years with entire safety—packages which were packed with little thought of heat sterilization or of any such practice being necessary, but to make assurance doubly sure, the product of the past season was subjected to extreme temperatures, and while it is conceded that the great bulk of the output does not require any such treatment, the industry, whose trade and reputation is at stake, and the officials who have the responsibility of guarding the health of our cities and states, naturally propose to take no chances. Hereafter the products will be sterilized—as they have been during the past year—in such fashion that even the one can in a million will be rendered safe.

Many Agencies Cooperate.

The spirit of cooperation and the constructive attitude taken by the various agencies of the state, particularly the State Board of Health and the two great universities, have been most timely and gratifying. The National Canners' Association, which has assisted, through its research department, continues its interest and its activity. The Bureau of Food and Drugs Inspection of the United States Government and the Bureau of Chemistry, as well as the Public Health Service, have all extended the helping hand because they realize perfectly well that the ripe olive is a most valuable food product, which should be and could be given to the consumers of this country as a valuable part of their diet and in perfect safety.

The industry is taking fresh courage and is rewarded by the response of the trade throughout the country. An advertising campaign of educational value is being conducted in magazines of national circulation.

Large Production of Olives.

So this industry which means so much to California, will continue to prosper, in spite of the natural anxieties which have arisen during the past year. When one realizes that there are approximately 38,000 acres of olives

planted in California, a considerable portion of which have not come into bearing, and when one realizes that the total production of olives in the season of 1919-1920 for California is placed at 7700 tons, it will be seen what a serious problem was presented to the growers of the state. Of this last crop, it is estimated that 5800 tons were produced of the ripe pickle olive, 1200 tons of the oil olive and 700 tons processed by the salt-cure method.

If the growers could be assured of a reasonable profit, the acreage in this variety would be enormously increased, as there is a vast extent of land in California entirely suitable for the growing of olives. When one realizes that Spain has upwards of three million and a half acres in olives, Italy two million, seven hundred thousand acres, Greece over six hundred thousand, Turkey over five hundred thousand, Portugal over five hundred thousand and a further quantity of over a million acres in North Africa, France, Algiers, Austria, one can see that with reasonable encouragement the industry would become one of the most important in California. The total foreign acreage is estimated at nine million, two hundred and sixty-eight thousand, while California's present acreage is estimated at thirty-eight thousand.

NUTRITIONAL WORTH OF RIPE OLIVES.

By M. E. JAFFA, M. S., University of California, Consulting Nutrition Expert,
California State Board of Health.

It is extremely gratifying to be able to state that canned, ripe or mature olives may be placed on the market with absolute safety to the consumer. The mature olive is also protected as to the oil content by the ruling of the U. S. Dept. Agriculture, Bureau of Chemistry, which has rendered an opinion, in effect, that as a tentative standard of maturity for Mission olives and other common varieties except the Manzanillo, Ascolano, Sevillano, an oil content of 17 per cent in the flesh is regarded as a minimum. This will protect the honest packer and safeguard the food value to the consumer.

The great difference between the mature and immature Mission olive will be appreciated by the examination of the table given herewith:

	Water	Protein	Fat	Carbohydrate	Ash	Fuel value per pound
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Olive, ripe or mature	69.60	2.00	21.00	4.00	3.40	958
Olive, immature	78.41	2.43	12.90	1.78	4.48	598
Pickles	93.80	1.10	.40	4.00	.70	110
Bread	35.30	9.20	1.30	53.10	1.10	1215
Meat, round steak	67.80	20.50	10.60	----------	1.10	835
Rice, raw	12.30	8.00	.30	79.00	.40	1630
Rice, boiled	72.50	2.80	.10	24.40	.20	525
Potato, edible portion						
raw	78.30	2.20	.10	18.40	1.00	385
boiled	75.50	2.50	.10	20.90	1.00	440

Comparing the ripe and green olive, it will be noticed that the percentage of fat or oil in the latter is only about 60 per cent of that yielded by the former. This would appear to be, according to the chemical analysis, the main difference between the green and ripe fruit, which difference is further confirmed by the figures indicating the fuel value of calories per pound.

In this connection it should be stated that the figure for oil in the ripe olive is that which the ripe fruit should yield. Unfortunately, however, there are on the market a large number of olives labeled "ripe olives" which contain far too low a percentage of oil.

More Nutriment In Ripe Olive.

Furthermore it may be said that the difference in oil does not indicate the whole difference between the two forms of fruit because undoubtedly the nutriment in the ripe fruit is in a much more digestible form than in the green. The green fruit, the common variety, is unripe and therefore to a certain extent immature. It is readily seen that it is to the interest of the consumer to buy the ripe olive rather than the green in that

he receives for his purchase far more nutriment in one case than in the other.

This, however, is not the only interesting point brought out by a study of the table. Bread is generally considered to contain, weight for weight, far more nutriment than is found in the olive, yet as far as the total food value, expressed in calories, is concerned, it will be noted that in one pound of ripe olives there is practically three-fourths of the caloric value noted for bread.

Raw Rice vs. Ripe Olives.

Again, if we compare the ripe olive with raw rice, the rice will rank far ahead in total food value; that is, in one pound of raw rice we have much more nutriment than in one pound of olives. If, however, we compare the rice as eaten with the ripe olive which is ready for consumption, it will be noticed that in one pound of ripe olives there is practically twice as much nutriment, if we take the calories as a basis for comparison, in the olive as in the rice. This is a point quite often lost sight of when comparing food values.

For instance, in a pound of dry macaroni there is far more nutriment than in a pound of ripe olives. Again if we compare both foods in an edible condition, the case is different and the comparison is in favor of the olives in that in a pound of cooked macaroni we have about 400 calories while in a pound of olives, edible condition, we have between 900 and 1000 calories. It is therefore seen that the ripe olive, as far as food value is concerned, compares very favorably with many of the ordinary foods.

Ripe Olive Not a Condiment.

It is not always correct, however, to compare food values on the basis of calories alone because the real value of the food to the body depends on the intended purpose more than on the calories. For example, one pound of sugar contains 1820 calories, one pound of meat less than 1000, yet one would hardly say that one pound of sugar is equal to a pound of meat when the question of growth is concerned, and similarly with reference to olives. One pound of olives with 1000 calories, if we are considering growth and replacement of wornout nitrogenous tissues, would not be worth to the body as much as a pound of meat with 1000 calories, but as a source of muscular energy the olives would be a most excellent supplement to foods such as meat or fish and cereals.

Summarizing in brief, then, it may be said that the ripe or mature olive is a very valuable, palatable, and easily digestible form of food and should be considered as such and not as an accessory or condiment.